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ABSTRACT

Disadvantages and advantages that physical therapy and allied health programs have encountered in utilizing a mastery learning approach are identified, based on a literature review and questioning of health educators. Recommendations concerning the implementation of this approach at California State University, Fresno are offered, along with a time table for the post-baccalaureate curriculum. Experiences with mastery learning by the following disciplines are covered: physical therapy, nursing, medicine, and social work. The following problems (and effective solutions) are considered: time commitment for developing a mastery learning curriculum, faculty resistance to change and lack of knowledge about developing learning packages, costs to produce modules, registration problems, and difficulties in measuring all unit objectives on one unit exam. Advantages of mastery learning include: competencies and standards for mastery are preset and clear; the use of competencies encourage faculty to develop relevant learning experiences; faculty spend less time lecturing and become resource persons and managers of educational processes; and increased frequency of testing provides feedback and redirects learning efforts. A comparison of mastery learning and competency based education on various components is included. (SW)

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USE OF MASTERY LEARNING APPROACH IN ALLIED HEALTH PROGRAMS

Emergence of Higher Education

by

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A Practicum presented to Nova University in partial fulfillment of the requirements for the degree of Doctor of Education

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ABSTRACT

Physical therapy program faculty at California State University, Fresno (CSUF) have a policy of allowing course grades to be determined by averaging all unit exam scores. Faculty members have recently become concerned that averaging exam scores may result in students receiving credit for courses in which they have not mastered all competencies. The concept of mastery learning has become intriguing to the faculty and they desired further information.

A directive issued by the chairperson of the program led to this study. The directive was to identify problems (and applicable solutions) that physical therapy and allied health programs have encountered when utilizing a mastery learning approach in their curriculum. A report was to be made to the faculty along with a recommendation regarding whether to implement such a program at CSUF.

Information was collected from a literature search, correspondence and conversation with allied health educators. Common problems encountered when mastery learning had been implemented into their curriculum were identified. Applicable solutions were also noted.

An oral report based on the above findings will be presented to the CSUF physical therapy faculty. A recommendation will be made that a mastery learning approach be adopted at CSUF. Strategies and a proposed schedule of implementation are contained in this practicum report.

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INTRODUCTION

Since completion of a major curriculum revision, the faculty of the Physical Therapy Program at California State University, Fresno (CSUF) has turned its attention to other aspects of the program. One area of concern is that several instances have occurred where students have not passed one or two unit exams, but have gone on to pass a course because their overall average was at a passing level. The circumstance is not unusual because this method of grading (averaging of all test scores) has been used in the program since its inception. What is different is the faculty's view of grading. When the curriculum revisions were written, many terminal objectives, or competencies, were developed for both academic courses and clinical performance. Specific cirteria for passing were written for each clinical competency, such that a student must prove mastery by obtaining a minimum score of three (on a one to five scale) for each clinical competency in order to receive a passing grade in clinic. Clinical scores could not be averaged. The faculty is now questioning whether students should continue to be allowed to average unit exam scores in academic classes, or if they should be required to prove mastery of subject content on each unit exam, similar to the way clinic is graded.

Several items of concern over the above-stated question have been raised during faculty meetings. For instance, how many times could a student repeat exams to prove mastery? Would they not become test wise if repeating the same exam? Who would write and correct the repeat exams? Would students drop out of the program due to frustration? These

questions and many others led to a directive from the program chairperson to gather information on how mastery learning is being implemented in other programs of allied health, what problems they have encountered, and how they have solved them. From information gathered, a recommendation was made as to whether the physical therapy program at CSUF should implement a mastery learning approach in its academic courses.

The method of investigation was basically a literature review. In addition, correspondence with professional associations and programs, and informal faculty interviews were undertaken. A faculty group discussion of nursing and health educators was attended, at which time a canvas of mastery learning at various institutions took place (Nawy, 1984).

BACKGROUND AND SIGNIFICANCE

This practicum developed in response to the attempt of the physical therapy faculty at CSUF to learn more about the mastery approach to education. Of specific interest were identification of problems encountered when such a system was utilized in other programs. The chairperson of the CSUF program directed that a study be undertaken and a report made to the faculty, including a recommendation regarding whether to adopt a mastery learning approach at CSUF.

The practicum was conceptualized during the seminar "Emergence of Higher Education." In that seminar, the history and development of higher education was studied, from the earliest medieval universities to the universities of today. A review was made of the various approaches to teaching and the assessment of student learning. Inspired

by that seminar, and realized in this practicum, was a search for knowledge of the historical development of the mastery learning concept.

Evolution of Mastery Learning

The concept of mastery learning has had a long and circuitous evolution. In European universities of the Middle Ages there were no exams other than recitations and disputations. Following five years of study, students underwent a questioning session and then a public disputation. The student was awarded a "baccalarii" or bachelor's degree after orally defending a given number of questions (Durant, 1950:929). The literature is unclear as to how passing grades were determined, or if grades were used in this time period.

Early American universities modeled their examination procedures after the European universities. Smallwood (1935:9) reports that until 1775 degrees were obtained by passing a public oral exam after a varying number of years in residence. By 1833 written exams were being used and frequency of exams increased (Smallwood, 1935:15). Harvard professors stated that interval exams induced students to "master a subject rather than memorize it" (Smallwood, 1935:29).

At this time, grading standards were not uniform, nor were they apparently enforced (Veysey, 1965:359). Laxity of academic standards may have been reflective of the desire of colleges to attract students at a time when only the elite attended college (Rudolph, 1962:225).

The Industrial Revolution ushered in mass education. Pressure for standards of measurement of academic performance increased. Primary and secondary educational institutions responded by establishing national norms and norm-referenced exams (Torshen, 1977:11).

Yale was one of the first universities to use objective grading methods in 1813, with a scale of four decimals. Harvard soon followed and began grading on a 100 percent basis in 1877. Mt. Holyoke College was using percentages and letter grades by 1896 (Smallwood, 1935:43-51).

The concept of assigning grades is well accepted in the 1980s. Several methods of grading are in use and the levels at which grades are set varies. Professors may utilize a norm-referenced method of evaluation or choose to grade by percentages or points. Grades may be reported as letters, pass/fail, or as a narrative evaluation.

Throughout the history of higher education, as described above, professors have been challenged to measure to what degree students have learned a given subject. Professors of the early colleges apparently held the criteria for passing in their minds. Students were examined orally until the professor was satisfied of the student's knowledge base. Smallwood (1935:104) found that until the beginning of the eighteenth century, European university professors did not doubt their ability to judge a student's achievements.

Objective methods of measurement were demanded when mass education became a reality. Norm-referenced grading led to a determination not only of whether a student had mastered the material at a minimally acceptable level, but how far above or below that level they had achieved.

Criticisms of norm referenced grading are many. The most common criticism is that it sets up competition between students, with a concomitant loss of self-esteem by those students who tend to perform at a level of less than average. This is particularly true of younger students, who may be placed in certain learning categories early in

their school career. Low self-esteem and low expectancy of success may persist in these children into adulthood.

An alternative to norm referenced grading is mastery learning. Proponents of mastery learning believe that ranking learners according to achievement norms may be emotionally damaging. The basic principle of mastery learning is that given enough time, 90 percent of students can "master" subject content at a predetermined, publicly stated level of competency (Carroll, 1963:724). This is in contrast to group-based learning where only a certain number of students are expected to perform at high standards within a given time period and achievements would fall along the pattern of a normal curve.

Two major attempts to introduce the mastery learning concept occurred in the 1920s in the United States (Block, 1971:3). To allow students unlimited time to learn necessitates alternate learning approaches and remedial packages. The lack of technology to develop learning packages prevented mastery learning from being widely adopted.

An upsurge of interest in this approach occurred as part of the programmed instruction movement in the 1960s and early 1970s. Postlethwait (1972) augmented the programmed instruction approach by using audio-tutorial modules, and later added slide-tape modules and film strips. The technology was now available to develop alternate learning style packages and remedial modules so that students could progress at their own speed of learning. Articles were written propounding the benefits of mastery learning and instructing teachers in how to establish such programs (Torshen, 1977) (Block, 1971) (Carroll, 1963, 1970) (Bloom, 1968).

Mastery learning has been adopted at all levels of education from primary through university in various institutions or classrooms (Torshen, 1977) (Benninga, 1983) (Block, 1971). It has not been widely adopted by all disciplines. The use of mastery learning in physical therapy and other allied health programs will be explored in the next section.

Mastery Learning in Physical Therapy and Allied Health Programs

Of physical therapy program directors who have had articles published regarding their curricula, Broski (1979), Barr (1977), and Chidley (1979) have provided excellent guides to curricular development, but their programs were not involved in mastery learning. Broski and Barr were using competency based education (CBE). Chidley reported that the physical therapy program at Ohio State University has been involved in a CBE project, but had not adopted CBE in its entirety. She stated that, due to time constraints, tests were given in the "traditional manner" and repeating of courses could become a necessity (1984:1).

The physical therapy program at the Medical College of Georgia (MCG) has received publicity through articles written by its director (May, 1977, 1978, 1979, and 1980) and others (Perry, 1981). Chidley (1984) referred to MCG as using a mastery approach. Yarbrough (1984), director of the Education Department of the American Physical Therapy Association (APTA), noted that she knew of only one physical therapy program involved in mastery learning and that was MCG. Michels (1984), Associate Executive Director of Research and Education, APTA, concurred with Yarbrough.

"A blend of competency based education, self-directed learning and problem solving" is how May (1984:1) described the physical therapy program at MCG. May (1978:234) stated that "traditional competency based education provides the student as much time as necessary to attain the desired competencies." What sounded like mastery learning at MCG was actually a modified approach due to limited resources and faculty. Students must meet a minimal acceptable level of performance in each unit before progressing. A failure would result in remediction and retesting with a new test. A second failure would result in dismissal, suspension, or probation with limitations on continued progression. When units of instruction are offered once a year only, students must leave the curriculum for a year. The goal of the program is to graduate all students since a selective admissions process is used. In a few instances, students are allowed to progress through the courses, but only those courses designed for nondirect patient care.

Although these procedures have been in effect for fourteen years, May (1984) reported very few failures for academic reasons, with an attrition rate of only 1 to 2 percent. Only three students had been dropped for academic reasons and three students took three years to complete the two-year curriculum (May, 1978). To date, there has not been more than one repeat student in a class.

All exams are criterion referenced. Often unit exams cannot measure all objectives, so comprehensive final exams may be given. Comprehensive finals would measure integration of enabling objectives into the broader course objectives.

In the modified mastery approach used at MCG, students are not given unlimited time to master competencies. Because of the limitation

on time, criteria for acceptable performance has been set at a 75 percent performance level for nondirect patient courses such as anatomy, administration, research and communications. An 80 percent performance level has been set for all other courses.

Grade assignment, by university policy, is a must at MCG. The faculty has agreed upon an arbitrary designation of grades, with a grade of C considered minimal acceptable level of performance, or mastery. In nondirect patient care courses, students must achieve 75 percent, with grades being assigned as follows: A = 92-100%; B = 83-91%; C = 75-82%. In all other courses students must achieve an 80 percent mastery level, and the grade scale would be A = 92-100%; B = 83-91%; and C = 80-82% (May, 1978:237). Grades below C indicate nonmastery and are considered failing.

Some of the advantages of using a modified mastery approach were listed by May (1977). The following were included:

1. Encouragement of relevant learning experiences to help the student attain competencies.
2. Reflection of the degree to which a student has achieved the competencies by examination.
3. Active student involvement in mastery of competencies.
4. Internalization of student motivation.
5. Diminished competition between students.
6. Improved clinical evaluation.

May lists few disadvantages with mastery learning. The major problem seems to be that the few students who have academic difficulties require more faculty time than the many who do well. Apparently, the

faculty is currently working on academic policies to cope with that problem (May, 1984).

The literature did not yield further reports on the use of mastery learning being used in physical therapy programs. Certain nursing programs are using mastery learning in a modified version as part of competency based education (CBE) (Nawy, 1984) (Herrscher, 1984). In a discussion of health educators led by Nawy (1984), many nurse educators indicated that they allow students to retake exams to achieve mastery. Two retakes were the most anyone allowed. All present agreed that test retakes were time consuming to faculty who must develop, administer, and correct extra exams. Unlimited time to achieve mastery was not allowed. While repeating a unit, students generally were allowed to progress into the next unit of a course, but were not allowed to fall behind more than two units. Students who exceeded these limitations did not pass the course and had to retake the entire course. Remedial work was given to help students obtain mastery.

Although the nursing program at California State University, Fresno (CSUF) has many audiovisual resources available, a mastery learning approach is not used. Nishio (1984), a professor in the CSUF nursing program, states that there is not enough time for students to learn in a self-pacing manner. Competencies are made available to all students. The established level of mastery, or passing, on all written tests is 70 percent. Retesting of written exams is not allowed. Remedial work is suggested where necessary. The final course grade is an average of all exam scores. Nishio predicted use of a modified mastery learning approach in the fall 1984 laboratory courses, where a faculty person has been hired to supervise the clinical skills labs. Having a

supervisor available in the labs would allow students to review those psychomotor skills that they had not yet mastered in preparation for retesting.

Numerous articles have been written about nursing education. None were found that addressed the issue of mastery learning as a singular approach. O'Neill (1980) describes a program which considered itself competency based, but did incorporate self-paced learning using audiovisual modules, instructional packages and videocassettes of lectures. Students worked at their own pace. Faculty became role models to validate and clarify concepts. Weekly mastery tests were scheduled (with 80 percent passing level) with set time periods by which students had to show mastery or complete the exams during the semester. Summative exams were given to reinforce synthesis of course competencies.

When deemed necessary, students were given remediation prescriptions and repeat testing prior to advancing to the next year. If a student failed to master 80 percent on 40 percent of course content, he would be dismissed from the program. In the event of "extenuating circumstances," a review of the dismissal would be given by a forum of faculty and students. Enrollment had dropped only 2 percent since the modified learning program was implemented (O'Neill, 1980:25).

Development of test items for the learning modules was time consuming for faculty. Use of computers was limited, as was faculty knowledge of computer technology. For these reasons, writing three equivalent tests for each module was found to be superior to computer banking.

Another problem for faculty was finding time to develop modules or learning packages. This problem was solved by obtaining relief time

for some of the faculty, while clinicians were hired to carry their teaching load.

According to 1974 and 1975 reports, the Mount Hood Community College nursing program in Gresham, Oregon, utilized a modified mastery learning approach. Student self-pacing and multiple entry-exit points were available. Grades were either A, B, or incomplete (I). The unlimited time to complete an incomplete tended to overload the faculty with remedial work.

The Mount Hood report listed problems similar to those reported by O'Neill (1980) in terms of implementing a modified mastery approach:

1. Extra time needed to train faculty in the concepts, design, and implementation of the new curriculum.

2. Extra time needed to develop learning packages.

3. Extra time needed to develop audiovisual materials.

4. Extra time needed to develop alternative and supporting materials.

Medical education is another area reportedly using a mastery learning approach, or modifications thereof. McGaghie (1978) saw mastery learning as part of competency based education (CBE). He defined mastery learning as "given adequate preparation, specific learning goals, sufficient learning resources, and a flexible time schedule, students can (with rare exceptions) achieve the desired competence at high levels of proficiency" (1978:19). Sorlie (1973) reported that such a method often works quite well with independent learners, and described how one group of medical students satisfied the basic science requirements in one year, when the normal time required two years. Because of rapid disappearance of unused knowledge, McGaghie

felt faculty should organize competencies and subject matter so it is applied as it is learned, in a problem-solving manner.

Silber (1978) wrote on the fifth year experience of the Southern Illinois University School of Medicine using CBE. Self-pacing was used, alternate learning routes were made available, class attendance was optional, and faculty-student help sessions were scheduled on a regular basis. Frequent evaluations assessed mastery of modules, units, blocks, and finals. Students were allowed to recycle a requirement from one module to the next, but not to the next course. Remediation periods were held at the end of each course. Students unable to manage regular and remedial work were dismissed or started over in the program. Year-end failure rates were reported to be no higher than the national norms for medical schools (1978:476).

Some of the disadvantages of the system, according to Silber (1978) were increased printing costs and increased use of faculty time in creating initial curriculum documents. The advantages were decreased lecture time and an increase in individual student-faculty sessions. Overall there was no decrease in faculty time demands.

Shepard (1981) reviewed a social work program that utilized competencies, was student paced, allowed more than one attempt to meet a competency, but required that all competencies be met in the traditional time limitation. Students were responsible for their learning and keeping track of their progress. The positive results were increased clarity of expectations, increased student responsibility for learning outcomes, and increased skill orientation. Faculty and students felt that the approach was somewhat restrictive and excluded certain types of learning activities.

Gross (1981) pointed out that moving to a competency based or mastery learning approach to education resulted in common problems for social work educators. A survey of thirty-one deans and directors of social work programs revealed that most faculty involved in mastery learning had shifted their roles towards management and coach, and away from primary resource. Faculty reported no difficulty writing objectives or competencies. Ninety-two percent reported obstacles to designing multiple elements of learning, media, and individual or self-paced learning modules (1981:73). According to Gross, the literature is lacking in the areas of instructional design.

In summary, the literature is somewhat lacking in articles on the use of mastery learning in physical therapy and allied health. Often programs which reportedly use mastery learning are actually using competency based education or a modified approach to mastery learning. Exact methods of how mastery learning has been implemented, advantages or disadvantages to such a system are not available in all reports. Problems which have been encountered, and workable solutions, are not always addressed. Articles reported on in this practicum were chosen because they most clearly addressed the above issues and were helpful in developing a recommendation to the physical therapy program at CSUF concerning the inclusion of mastery learning in its program.

DEFINITION OF TERMS

The term mastery learning and competency based education are often used synonymously in the literature and in practice. A hybrid of the two approaches was found frequently in programs reporting to use one or the other. Specific definitions of educational terms used throughout

this study are found below.

Evaluation--For the purposes of this study, the terms evaluation and examination were assumed to be synonymous. An evaluation is a means of determining the extent to which a student has achieved the stated objectives. An examination can be written, oral, or practical, and could assess the cognitive, affective, or psychomotor domain.

Formation Evaluation--An evaluation given during the process of an instructional unit. It is designed to provide feedback and guidance to the student. It may also serve as a diagnostic tool for the instructor. Formative evaluations are nongraded under a mastery learning appracoh.

Summative Evaluation--An evaluation given at the end of a unit of instruction to determine to what extent the student has achieved the unit objectives. These exams are usually graded regardless of the educational approach being applied.

Grade--A value assigned to a corrected examination in terms of predetermined criteria. This value would give an indication of the degree to which the student attained the objectives.

Competency Based Education--An approach to education which focuses on student attainment of a hierarchy of competencies, or objectives. The objectives are made available to the student. Instruction is organized into learning experiences designed to facilitate sequential learning of objectives. When exams are given, they are criterion referenced to the objectives. Instruction is usually instructor-paced.

Mastery Learning--An approach to education which contains the philosophy that given specific goals/objectives, a variety of learning resources arranged sequentially, and a flexible time schedule, most students can achieve the desired levels of competence. Student-paced

learning is one of the main differences between competency based education and mastery learning. When working with a highly select group of students, the time necessary to learn is expected to diminish.

Mastery--Attainment of proficiency in performing a competency according to a preset standard. In competency based education, a student could "master" competencies without necessarily being involved in a mastery learning approach.

LIMITATIONS OF THE STUDY

1. This study was limited to reporting on information about mastery learning which was described in books, articles, and published reports. The focus of the study was mastery learning as applied by physical therapy and allied health programs. Additional information was obtained through correspondence and personal conversations with health educators. Given this information, it is possible that a number of programs using mastery learning were omitted from the study.

2. This study was designed as an open-ended search for information. Problems, and related solutions, inherent in implementing a mastery level approach in health professions curricula were identified as information was gathered. Gaps in information occurred where authors failed to address these issues adequately, or where reports were of a different focus than problem identification and solution.

ASSUMPTIONS

1. An assumption was made that directors of health professions programs are eager to share information about their curricula, particularly if they are involved in an innovative process such as mastery learning.

2. It was further assumed that a large number of reports of such projects would be published in an effort to disseminate information.

3. A final assumption was that published reports would contain an analysis of problems encountered in establishing mastery learning into a curriculum and provide details of solutions to those problems.

PROCEDURES

This practicum involved a review of allied health educational programs which are using a mastery learning approach and have evaluated its effectiveness. Correspondence with the Education Section of the American Physical Therapy Association and with authors known to be working in such a setting provided information on physical therapy programs that utilize mastery learning. Related references were made available by these sources.

Two computer searches of the Educational Resources Information Clearinghouse (ERIC) data base were completed using descriptors such as "allied health occupations education," "mastery learning," and "competency based education." The outcome was a bibliography closely related to the practicum topic. Several articles contained excellent reference sections which yielded additional information. Indices of professional journals such as Physical Therapy, Nurse Outlook, and Nurse Educator were used to further identify related articles. Additional information was obtained through personal conversation or correspondence with allied health educators.

The literature search encompassed use of both mastery learning and competency based education in allied health programs. Often programs of allied health were found that used what they termed

mastery learning. Upon inspection they were found to be using a modified mastery approach or a competency based education approach. Faculty who wrote that they used competency based education often also utilized a modified mastery approach.

Advantages and disadvantages of using mastery learning, or a modification of such, were extracted using the procedures described. Only articles which addressed those issues were chosen for this practicum. Because of the open-ended approach to problem identification and related solutions, both will be addressed in the results section. Discussion and clarification will occur in later sessions.

The physical therapy program at CSUF was analyzed in terms of faculty composition. Problems inherent in adopting a mastery approach were compared to the current curriculum at CSUF to determine whether those problems could be overcome. A recommendation was then made along with further suggestions.

RESULTS

The procedures of the study resulted in identification of common problems which were encountered when various allied health programs moved into mastery learning or a modification thereof. The majority of programs had found workable solutions to the problems. For the purposes of clarity of presentation, each problem will be presented with solutions that were found to be most effective.

Time Commitment

A substantial time commitment is involved in developing a curriculum based on mastery learning. Mission statements, philosophy

statements, course objectives, and unit objectives must be developed. Modules and learning packages to meet alternate learning styles and remedial instruction must be produced. A bank of exam questions will be necessary for use in test retakes. Once curriculum is developed, the smaller units of instruction require increased faculty time for test administration and correction. Allowing test retakes demands more faculty time. These demands are further increased when students are allowed unlimited time to acquire mastery.

Recommended Solutions

The initial time commitment to develop a new curriculum has no immediate solution. To ease the problem, one program arranged for faculty relief time (Mount Hood, 1974). Clinicians were hired to teach classes. Formative evaluations were developed that were student directed and nongraded. Once a pool of test questions was developed, alternate exams were generated in less time. Student assistants were hired for one program to correct test retakes (O'Neill, 1980).

Of programs studied for this project, all utilized a modified mastery approach. Students were not allowed unlimited time to master materials. Only one or two test retakes were allowed. A limit was placed on the number of repeat units a student could carry during a course (usually two units). Some programs required mastery on only a percentage of the competencies (O'Neill, 1980) (May, 1977). When students were unable to maintain satisfactory progress, they were given grades of incomplete and had to repeat the entire course. Rather than drop out of the program while waiting for a course to be offered again, students were allowed in one program to continue to progress in those courses identified as "nondirect patient care" (May, 1984).

Faculty Education

Health professionals are often unfamiliar with educational theories and jargon. Faculty may not have technical knowledge of designing learning packages with associated media. In addition, faculty may be resistant to change.

Recommended Solutions

Faculty education workshops were conducted by many programs to give faculty a working knowledge of educational theory and methods. Certain programs had staff from campus media centers give presentations on technology used in development of instructional modules. Early involvement of faculty in the curriculum process alleviated much of the resistance to change.

Costs to Produce Modules

Increased costs were incurred to print instructional packages or produce learning modules. This could produce budgeting problems in small programs. Purchasing of commercially prepared products saved faculty time but increased budget expenditures.

Recommended Solutions

Certain programs received grants to implement the entire curricular changes over a period of years (Mount Hood, 1975) (O'Neill, 1980). Faculty were encouraged to apply for instructional improvement funds. Once modules were produced, expenses diminished.

Registration Problems

Registration problems resulted when student-paced learning was implemented. Some students would finish coursework early, others would

finish after the semester ended. This pattern of academic accomplishments did not correspond with established registration systems.

Recommended Solutions

Several unique approaches were implemented to deal with the above problem. Many programs modified the mastery approach so that courses remained the traditional length (May, 1978) (O'Neill, 1980) (Shepard, 1981) (Silber, 1978) (McNamara, 1978). Incomplete grades were given to students who did not master the competencies during the established time period. Remediation periods were held at the end of courses. One program arranged with administration to register students within the department during the semester (Mount Hood, 1974).

Assessment of Competencies

When using smaller units of instruction, some faculty reported difficulty measuring all of the unit objectives on one unit exam. In addition, as students progressed through the units, they tended to forget earlier competencies. Students did not appear to be synthesizing objectives in a hierarchy.

Recommended Solutions

Certain programs administered comprehensive final exams. These exams required students to review previously studied materials. The exams measured synthesis of unit enabling objectives into broader course competencies. Problem-solving situations presented as case studies required students to synthesize and apply all of the course objectives.

Advantages of Mastery Learning

Once the above problems were dealt with, the directors of the programs studied were apparently satisfied with the decision to move to a mastery learning approach. Published reports placed emphasis on the advantages of such a system. A synopsis of the advantages follows:

1. Competencies and standards for mastery are preset and clearly presented. The guessing game is removed as students know exactly what is expected of them. This allows students to assume increased responsibility for their own learning. They become actively involved, which increases motivation. In most cases students master the competencies in less time than with a traditional learning approach (Sorlie, 1973) (Mount Hood, 1974) (Silber, 1978) (McGaghie, 1978). Student competition decreases as exams become criterion referenced.

2. The use of competencies encourages faculty to develop relevant learning experiences to help students achieve the objectives. Curriculum becomes more meaningful when it is arranged sequentially and according to major competencies, rather than compartmentalized. Faculty have accountability in that they can certify the degree of student mastery of publicly stated competencies. The use of problem-solving situations and case studies increases as a method to test synthesis of competencies.

3. Faculty spend less time lecturing and become resource persons and managers of educational processes. This allows more time for one-on-one help sessions. With learning packages or modules available, education does not stop when a faculty member is not on campus.

4. Increased frequency of testing provides feedback and redirects learning efforts. Students and faculty are aware of progress in all aspects of the learning process.

5. Use of a mastery learning curriculum process provides hard data in the event program revision becomes necessary.

DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS

The results of this study indicated that the mastery learning concept is not being heavily utilized in physical therapy programs. Nursing, medical programs, psychology, and social work appear to be utilizing the principles in greater numbers. Due to time constraints, students generally are not being allowed unlimited time to master competencies. A restricted number of test retakes are being permitted, beyond which the students receive grades of incomplete, or in some cases a failing grade. Attrition rates did not rise in any of the programs utilizing mastery learning concepts.

Students have responded to high criterion levels of mastery by increasing their work output to meet expectations (Thorman, 1982). Of major importance is that students are given objectives and criterion levels of mastery at the beginning of each course. Students did not become "test wise" with test repeats because alternate exams were formulated from pools of criterion referenced test items. Computers were being utilized by some programs to generate alternate tests. It was found that specific students may wish to repeat exams to earn higher scores. To discourage that practice, most programs allowed a maximum grade of C on test retakes.

Alternate learning strategies were in use by the programs studied. Although production of a variety of learning packages was time consuming, it had many advantages. Attempts were made to accommodate various student learning styles. Demands on teacher time for lecture was

decreased and faculty became managers of education. Students became responsible for their own learning with ample sources of review available.

The problem of students falling too far behind for failure to complete a course was handled in a creative way. Although a student would have to wait one year for the course to be offered again, he could progress in courses that were considered "nondirect patient care," such as anatomy, administration, communication and research. No reference was made as to how clinical experience was handled in those situations.

Analysis of CSUF Program

In considering whether a mastery approach was appropriate to the physical therapy program at CSUF, an analysis was undertaken in terms of current program curriculum and future plans.

A complete curriculum revision was undertaken in the program during the 1981-82 school year and implemented in 1982-83. The revision involved writing of program philosophies, goals and objectives, identification of terminal competencies and a major restructuring of classes. Objectives were written for each course and are in continued development at the unit level. Exams were reviewed by a committee to assure that questions required higher level cognitive functioning. Faculty were encouraged to write exams that involved problem-solving situations.

The revised curriculum is in use today. Only two full-time and one part-time professor remain of those who helped develop the new curriculum. Recently, four new full-time faculty members have been hired. They are currently teaching courses which someone else designed,

using objectives developed by someone else. For the most part they consider themselves clinicians and are unfamiliar with educational terms or theories. It would seem that before a new approach to education was presented to them, they should have a period of time to acquaint themselves with the current curriculum and its objectives.

The American Physical Therapy Association, accrediting agency for physical therapy programs, recently mandated that all physical therapy programs will move into a post-baccalaureate curriculum by 1990. Before any changes in curriculum can be made at CSUF, a proposal must be approved by the Curriculum Committee. This process usually takes two years. For these reasons the faculty must begin meeting soon to discuss changes and write out plans and procedures for implementing a post-baccalaureate curriculum.

Recommendation on Mastery Learning

An oral recommendation will be made at a faculty meeting that the physical therapy program at CSUF make preparations for implementing a mastery learning approach into its proposed post-baccalaureate curriculum. Rationale involves timeliness and the advantages of mastery learning. The time is right to begin the process since the curriculum will be reviewed and possibly revised for its 1990 mandate. The advantages of mastery learning are numerous and will be shared with the faculty during the presentation.

It will be recommended that a modified mastery approach be adopted that will fit within the traditional university semester time frame, but will allow students to do remedial work and retake tests to prove mastery. Competencies should be met at a minimum "C" grade level,

after which exam scores could be averaged to determine overall course grades. This process would prevent students from graduating with deficiencies in competency areas.

An implementation time table has been prepared. It would allow new faculty to become familiar with the current curriculum before radical changes are made. Provisions have been made for faculty instruction in educational theories and practices. The implementation time table will be presented and explained during a faculty meeting. The time table can be found in Appendix A. A discussion of the time table is found in Appendix B. In anticipation of faculty questions regarding the differences between a mastery learning approach and competency based education, a table has been developed that will be presented and explained during the presentation (Appendix C).

Changing to a mastery learning approach would improve the way students are currently documented for achievement of academic competencies. Rather than receiving the average of poor test results of one unit and high test results of another unit, the students who graduate from the physical therapy program at CSUF would have proven mastery of all competencies. If the purpose of state board exams is "to weed out those who are not competent to practice" (Wheeler, 1984), the purpose of educational programs should be to assure that all who graduate are competent. Consumers deserve this.

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APPENDIX A

IMPLEMENTATION TIME TABLE

Time Table for Implementing Mastery Learning
into Post-Baccalaureate Curriculum

Year	Activities	Inservices
1984/85	Discuss post-baccalaureate level. Review philosophies, goals, objectives in relationship to mastery learning. Revise above. Review Program grade policies. Discuss implementation. Apply for grant or financial help.	Mastery learning concepts, advantages and disadvantages.
1985/86	Resequence courses to new competencies Revise course competencies, objectives. Resequence course units.	Hierarchy of competencies. Construction of objectives, exam items.
1986/87	Develop unit objectives, formative evaluations, summative evaluations, test item pool or alternate tests.	Training in computer language, concepts.
1987/88	Develop final summative evaluations to test synthesis. Problem solving. Submit curriculum package to curriculum committee.	Training in design of learning packages.
1988/89	Complete and refine above	
1989/90	Results from curriculum committee. Revise as necessary.	
990/91	Implement new curriculum package.	

APPENDIX B

STRATEGIES FOR IMPLEMENTATION

STRATEGIES FOR IMPLEMENTING MASTERY LEARNING
INTO POST-BACCALAUREATE CURRICULUM

The year 1984/85 would involve faculty meetings to discuss ways of moving the current curriculum into a post-baccalaureate level. Program philosophies, goals and objectives would be reviewed and possibly revised to reflect mastery learning and graduate level requirements. Program grade policies, standards of competency, course repeats and student progression would be reviewed and revised. Decisions would be made on how to implement a mastery learning strategy. At this point in the time frame it would be prudent to apply for a grant or financial assistance. Faculty educational programs on mastery learning concepts, advantages and disadvantages would facilitate decision making.

In 1985/86 courses might be rearranged sequentially according to task hierarchy. Course objectives would be revised or resequenced to correlate with overall program competencies. Courses would be arranged into sequential and smaller units of instruction. Helpful at this time would be educational programs on the development of hierarchies of competencies. In addition, procedures in writing valid course competencies, valid exam items and criterion referenced tests would be of assistance to new instructors.

Unit objectives would be developed in 1986/87, along with formative and summative evaluation tools, a test item pool or alternate tests. Training in the use of computers for storage of test items, generation of exams, printing and correction would be helpful to

faculty who wish to use this technology.

In 1987/88 faculty would develop course final (summative) exams to test synthesis of higher level competencies. Problem solving situations and case studies would be developed. Three alternate tests or a bank of test items would be necessary for retesting purposes. By this year the curriculum package would be sufficiently prepared to present to the curriculum committee. Faculty inservices that year would include training and instruction in the design of learning packages or modules. These would include programmed learning, slide-tape, computer, film or videocassette.

By 1988/89 a refinement and completion of all previous activities could be undertaken. This would be a hiatus year while waiting for a report from the curriculum committee in 1989/90. When the report is received revisions may be necessary. These could be done in 1989/90/

In 1990/91 the new post-baccalaureate mastery learning curriculum package would be implemented. This would meet the mandate established by the American Physical Therapy Association. It would also allow time for new faculty to become oriented, learn and participate with knowledge in the transformation process.

APPENDIX C

COMPARISON OF MASTERY LEARNING AND COMPETENCY BASED EDUCATION

Table 1

A Comparison of Mastery Learning and
Competency Based Education

Components	CBE	ML
Pre-test	recommended	recommended
Written objectives	yes	yes
Sequential learning experiences	yes	yes
Criteria/pre-set standards of acceptable performance	yes	yes
Formative evaluations (feedback)	usually	yes
Grades given on formative evaluations	usually	no
Summative evaluations	yes	yes
Grades assigned to summative evaluations	yes	yes
Criterion referenced exams	yes	yes
Remedial learning (repetition) prescribed	usually	yes
Variety of learning strategies (use of technology)	usually	yes
Student-paced learning	no	yes
Re-takes on exams	sometimes	yes

(CBE = Competency Based Education) (ML = Mastery Learning)

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